REMARKS

The Office Action dated January 17, 2003 has been carefully considered and this Amendment prepared in response. Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and the remarks which follow.

The Office Action states that claims 1 – 13 were pending in the application, and that only claims 1, 2, 4-6 and 8-10 were examined.

In this response, claims 1 and 6 are amended, claims 4, 5 and 8-10 are cancelled, and new claims 15 and 16 are added. New claims 15 and 16 recite subject matter related to the previously elected species.

Applicants note that a Preliminary Amendment was filed with the application on October 17, 2001 which amended claim 13 and added new claim 14. In order to clarify the record, a copy of the Preliminary Amendment and the associated filing receipt are attached. The Examiner is requested to enter the preliminary amendment.

In sum, after amending the claims as set forth above, claims 1-3, 6, 7, and 11-16 are now pending in the application.

The Examiner is requested to confirm that the substitute specification filed on February 28, 2002 was received and entered into the application file.

In the Office Action, claims 1, 2, 4-6, and 8-10 were rejected under 35 U.S.C. § 112, 2nd paragraph as being indefinite; claims 1, 2, 4 and 9 were rejected under 35 U.S.C. § 102(b) as being anticipated by any one of U.S. Patent Nos. 5,677,938 (Glassmann), 4,285,769 (Specker), 3,385,758 (Gyorey), 3,929,565 (Fredin), or 3,147,191 (Crowther); claim 5 was rejected under 35 U.S.C. § 103(a) as being unpatentable over any one of Glassmann, Specker, Gyorey, Fredin or Crowther in view of the combination of U.S. Patent Nos. 3,917,768 (Abate-Daga) and 4,671,927 (Alsop); claim 6 was rejected under 35 U.S.C. § 103(a) as being unpatentable over any one of Glassmann, Specker, Gyorey, Fredin or Crowther in view of U.S. Patent No. 5,524,033 (Hida); claim 8 was rejected under 35 U.S.C. § 103(a) as being

unpatentable over any one of Glassmann, Specker, Gyorey, Fredin or Crowther in view of any of U.S. Patent Nos. 4,483,818 (Yamashita), 5,145,635 (Ishii) or 5,359,634 (Johannesson); and claim 10 was rejected under 35 U.S.C. § 103(a) as being unpatentable over either Crowther or Fredin in view of U.S. Patent No. 5,276,718 (Ueda). Additionally, the specification was objected to under 35 U.S.C. § 112 for informalities.

Revisions To The Specification Resolve The Informality Issues

The amendments made to the specification paragraphs resolve each of the informalities cited in paragraph 3 of the Office Action. No new matter is added by these amendments. Accordingly, withdrawal of the objection to the specification under 35 U.S.C. § 112 is respectfully requested.

The Amendment to Claim 1 Clarifies The Claimed Invention

Claim 1 is amended to clarify the invention claimed and to recite that the ratio B/S is in the range of 0.06 to 0.08 cm^{-1}. The numerical value range of the ratio B/S of 0.06 to 0.08 cm^{-1} recited in amended claim 1 is supported by the disclosures of the last paragraph on page 16, first paragraph on page 17, and second paragraph on page 21 of the substitute specification. The amendment to claim 1 clarifies that it is directed to a reactor core. Applicants submit that amended claim 1 is now clear, and withdrawal of the rejection under 35 U.S.C. § 112, 2nd paragraph is respectfully requested.

New Claims 15 and 16 Are Supported By the Specification

New claim 15 incorporates the subject matter of cancelled claims 4 and 5, and therefore, is supported by the originally filed claims and is a member of the elected Group and Species. Further, new claim 15 is clear and definite as to the claimed invention, and thus resolves the wording issues that formed the basis of the rejections of claims 4 and 5 under 35 U.S.C. § 112, 2nd paragraph. Claim 6 is amended to depend from new claim 15.

New claim 16 is supported by the specification, such as on pages 8, 21, and 22. Further, new claim 16 is a member of the elected Group and Species.

The rejections of claim 1-under 35 U.S.C. §§ 102(b) and 103(a) are traversed

After carefully reviewing the references, Applicants respectfully submit that none of those references disclose or suggest the B/S structural limitation recited in amended claim 1 and, therefore, those references do not anticipate that claim nor render it obvious.

It is first noted that the ratio of B/S is a ratio of the width (B) of each control rod blade to the surface area (S) of the square having sides equal to the pitch (A), and thus has the units "cm^{-1}".

None of the Glassmann, Specker, Gyorey, Fredin or Crowther references disclose any numerical dimensions of the control rod blade width and/or the square surface area of the surrounding fuel lattice. Also, none of the references disclose any importance or characteristic design factor associated with the B/S dimensional relationship. Thus, the dimensional limitation recited in amended claim 1 is not taught or suggested in those references.

The rejection improperly relies on the drawings to provide a basis for asserting that the claimed B/S ratio is anticipated by the five primary references. The rejection states that any one of the references which are cited in the rejection also shows a reactor core wherein the B/S ratio is 0.06 cm-1 or greater. The rejection then, however, admits that the drawings of the references are not to scale. Nevertheless, the rejection relies on *In re Mraz*, 59 CCPA 455 F.2d 1069, 173 USPQ 25 (1972) to negate this shortcoming. This reliance on the drawings as the basis for rejection is traversed for at least three reasons.

Firstly, if the drawings are not to scale, a B/S ratio cannot be extracted from them. It is submitted that there is no requirement that patent drawings must be made to scale, and, unless there is a specific indication in the document that such is the case, then the Examiner may not assume or rely on measurements which can be taken from the drawings to facilitate a prima facie case of anticipation.

MPEP 2125 "Drawings as Prior Art" states that:

> Drawings and pictures can anticipate claims if they clearly show the structure which is claimed. In re Mraz, 455 F.2d

> 1069, 173 USPQ 25 (CCPA 1972). **However, the picture must show all the claimed structural features and how they are put tog ther.** Jockmus v. Leviton, 28 F.2d 812 (2d Cir. 1928). The origin of the drawing is immaterial. For instance, drawings in a design patent can anticipate or make obvious the claimed invention as can drawings in utility patents. When the reference is a utility patent, it does not matter that the feature shown is unintended or unexplained in the specification. **The drawings must be evaluated for what they reasonably disclose and suggest to one of ordinary skill in the art.** In re Aslanian, 590 F.2d 911, 200 USPQ 500 (CCPA 1979). See MPEP § 2121.04 for more information on prior art drawings as "enabled disclosures."

However, this section then goes on to state that:

> PROPORTIONS OF FEATURES IN A DRAWING ARE NOT EVIDENCE OF ACTUAL PROPORTIONS WHEN DRAWINGS ARE NOT TO SCALE
>
> When the reference does not disclose that the drawings are to scale and is silent as to dimensions, **arguments based on measurement of the drawing features are of little value.** See Hockerson-Halberstadt, Inc. v. Avia Group Int'l, 222 F.3d 951, 956, 55 USPQ2d 1487, 1491 (Fed. Cir. 2000) (The disclosure gave no indication that the drawings were drawn to scale. "[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue."). However, the description of the article pictured can be relied on, in combination with the drawings, for what they would reasonably teach one of ordinary skill in the art. In re Wright, 569 F.2d 1124, 193 USPQ 332 (CCPA 1977). (emphasis added)

Secondly, the reliance on drawings in *In re Mraz* was limited to a situation where the reference drawing "focuses on the edge rolls, showing them with great particularity and showing the grooves thereon to have an angularity well within the range recited in appellant's claims." 455 F.2d at 1072 (emphasis added). That situation is not present here and so the reliance on *In re Mraz* is inappropriate. Specifically, the figures in the five primary references do not show details of the control rods in sufficient "particularity" to permit an easy measurement of the illustrated ratio. Further, Applicants' own rough calculations based upon the drawings

in the five primary references show B/S ratios less than the range of 0.06 to 0.08 cm^{-1} recited in amended claim 1. Thus, the five references clearly do not include drawings showing control rods with a B/S ratio "well within the range recited in [Applicants'] claims."

Thirdly, the drawings in the five primary references would "suggest to one of ordinary skill in the art" a B/S ratio less than the range cited in amended claim 1. As explained in the specification on pages 1 and 2, conventional reactors (i.e., those known in the art before the Applicants' invention) have refueling cycles of about two years and control rods with a B/S ratio of about 0.052 cm^{-1}. The specification explains (such as in the paragraph on page 8 amended herein) that increasing the B/S ratio enables a reactor design capable of operating for 15 years or longer. None of the five primary references teach a reactor core design that is capable of operating for 15 years or longer without refueling. In fact, Gassman teaches that the reactor should be refueled every 18-24 months (Col. 3, ll. 16-18). Since the control rod width, and thus the B/S ratio, is related to the reactor core refueling cycle and the five primary references relate to conventional reactor designs, the references and their figures would suggest to one skilled in the art a control rod design consistent with conventional designs, i.e., approximately 0.052 cm^{-1}.

The disclosures in Glassmann, Specker, Gyorey, Fredin and/or Crowther and their figures should not be interpreted or extrapolated (such as to assume dimensions not disclosed or suggested in the drawings or text) in view of the teachings of the Applicants' specification. As explained above, the specification notes that control rods in conventional reactor cores have a B/S ratio of about 0.052 cm^{-1} which is suitable for reactor cores with only a two-year refuel cycle. There is no suggestion or motivation in the five primary references to modify conventional control rods so that they have a B/S ratio of 0.06 to 0.08 cm^{-1} as recited in amended claim 1. None of the other references teach a relationship of control rod B/S to core life (or provide a motivation for extending core life) or provide any other motivation for modifying conventional designs or the teachings of the five base references. Since it would be an unnecessary additional expense to make control rods larger than required for a reactor core design, some motivation must be shown for departing from what is disclosed in

the references and what was known in the art at the time. Teachings in the Applicants' specification that a 15+ year core life is achievable, in part, by increasing the control rod size to have a B/S ratio of 0.06 to 0.08 cm^{-1} cannot be used as the motivation for modifying the Glassmann, Specker, Gyorey, Fredin and/or Crowther disclosures.

For the foregoing reasons, Applicants maintain that the cited references do not disclose the structure recited in amended claim 1, and that no obvious modification of the base references, absent the teachings of Applicants' own specification, nor any combination of all references disclose or suggest the structure recited in amended claim 1. Accordingly, Applicants respectfully request withdrawal of the rejections of claim 1 under 35 U.S.C. §§ 102(b) and 103(a).

Since claims 2, 3, 6 and 15 depend from allowable claim 1, as amended, Applicants also respectfully request withdrawal of the rejections of those claims under 35 U.S.C. §§ 102(b) and 103(a).

Since new claim 16 recites the same B/S ratio as in claim 1, Applicants maintain that this claim is also patentable over the cited references.

Finally, it is noted that cancellation of claims 8-10 addresses the rejections of those claims under 35 U.S.C. §§ 102(b), 103(a) and 112, such that this Amendment is fully responsive to the Office Action.

Applicants believe that the present application is now in condition for allowance. Favorable reconsideration of the application as amended is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

Respectfully submitted,

Date April 17, 2003

By _____

Robert M. Hansen
Attorney for Applicant
Registration No. 43,656

FOLEY & LARDNER
Washington Harbour
3000 K Street, N.W., Suite 500
Washington, D.C. 20007-5143
Telephone: (202) 672-5387
Facsimile: (202) 672-5399

MARKED UP VERSION SHOWING CHANGES MADE

Below are the marked up replacement paragraph(s):

Page 8, first paragraph:

Here, the ratio B/S is a numeric value corresponding to the blade width (B) of a control rod (blade) and the surface area (S) of the fuel lattice defined the surface area of a square whose side is equal to the pitch between the fuel assemblies. This numeric value (B/S) is roughly proportional to the magnitude of the control rod worth. According to the present invention, the control rod worth is markedly increased by raising the B/S value to 0.06 cm^{-1} or greater (as opposed to about [0.5] **0.05** cm^{-1} in **a** conventional type[d] of the nuclear reactor). Excess reactivity can therefore be adequately reduced even in nuclear reactors in which substantial excess reactivity is required, such as when an attempt is made to markedly extend the operating period (for example, to allow a reactor to continuously operate for 15 years and longer).

Page 9, second full paragraph:

Placing thorium in peripheral portions of each fuel assembly allows [promotes] reactions in which the thorium absorbs neutrons and converts to uranium 233. Reactivity can thus be reduced at the beginning of **the** cycle and increased in the second half thereof, making it possible to reduce the extent to which reactivity is adjusted by the burnable poison. As a result, more nuclear fuel material can be loaded by reducing the amount of gadolinia, and corrosion can be reduced because a lower burnup can be achieved while the amount in which energy is generated can remain the same.

Page 15, third paragraph:

As can be seen in Fig. 2, **in the present embodiment,** the area **of the reactor pressure vessel 201** underneath the core 202 [of the reactor pressure vessel 201 pertaining to the present embodiment is] **does** not [arranged] **contain** nozzles or other line connection

components. The main lines connected to the reactor pressure vessel 201 include the main steam pipes 215, water supply lines 216, emergency core cooling lines 217, and the like, all of which are disposed above the reactor core 202. In Fig. 2, a steam separator 209 is disposed upper the control rod drive housing 208, and a steam [driver] **dryer** 210 is disposed above the steam separators 209.

Below are the marked up amended claims:

1. (Amended) A reactor core [is] **capable of being** mounted [on] **in** a lower portion [in] **of** a reactor pressure vessel, **comprising a core support plate mounted on the lower portion in the reactor pressure vessel and an upper grid disposed on and above the core support plate, said reactor core** comprising;

[a core support plate is mounted on an lower portion in said reactor pressure vessel;

an upper grid is sat on above said core support plate;]

a plurality of fuel assemblies which are supported by [said] **the** core support plate and [said] **the** upper grid[,] **so as to be** [are] arranged in a square grid **form** at a certain pitch; and

[a plurality of cross-sectional cruciform control rods having each four blades thereof, are inserted into four adjacent spaces formed by said four fuel assemblies facing each other, wherein said reactor core is used to set a numeric value of 0.06 cm^{-1} or greater which is selected for the ratio (B/S) of a width (B) of each blade on said control rods and a surface area (S) of each fuel lattice defined by said surface area (S) of a square whose side is equal to the pitch between said fuel assemblies]

a plurality of control rods having a cruciform cross-section comprising four blades having a width (B), each of said control rods being adapted for insertion into four adjacent spaces between four fuel assemblies facing each other, wherein a ratio (B/S) of the width (B) of the control rod blades to a surface area (S) of a square having

sides each being qual to the pitch between the fuel assemblies is set in a range of 0.06 to 0.08 cm^{-1}.

6. (Amended) A reactor core as claimed in claim **[4] 15**, wherein said burnable poison is a gadolinia product, and combined enrichment of gadolinium isotopes with odd mass numbers in said gadolinia product is greater than the enrichment of natural gadolinium.